Book Review

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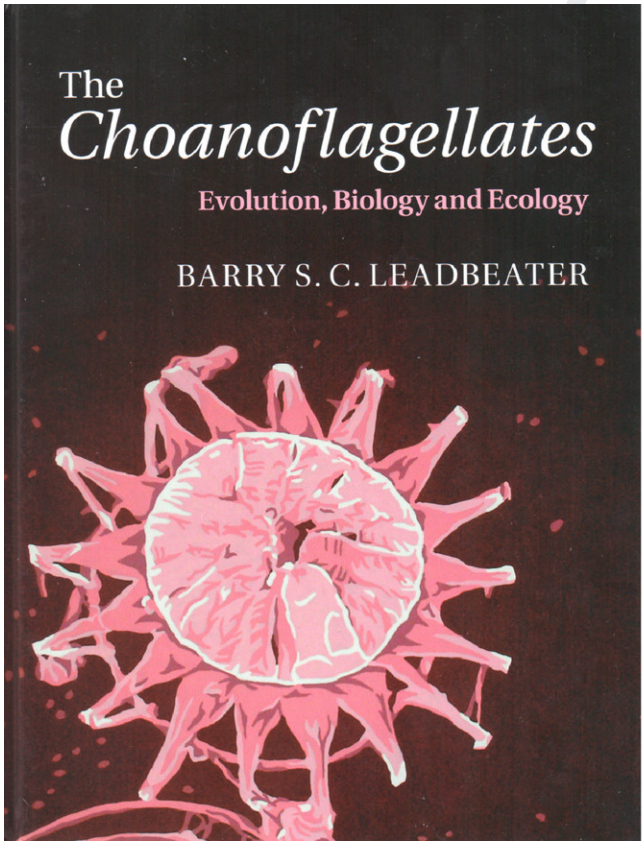
Leadbeater, B. S.

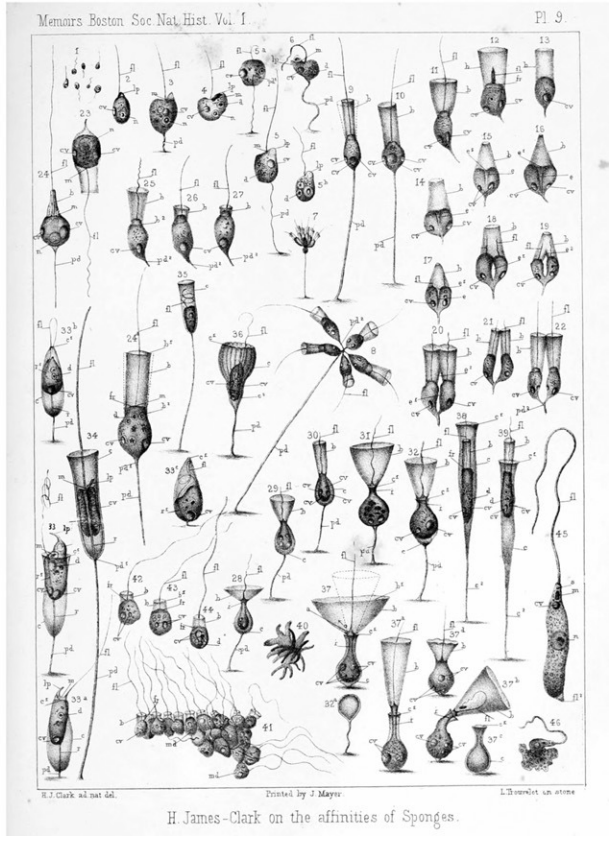
2015. The Choanoflagellates: Evolution, Biology, and Ecology. *Cambridge University Press, Cambridge, U.K. 315 pp., Hardcover, ISBN978-0-521-88444-0, $125.*

The choanoflagellates rank high among the groups of protists deserving a book of their own. This is because of their long history of study, controversial identity as ancestral to metazoa, as well in their own right a group of a fascinating morphological diversity, ontogeny and complexity in lifestyles. Barry Leadbeater has given us the book they deserve and every protistologist should have this in their personal library.

The first chapter is a historical perspective pointing out that the first unequivocal descriptions of "collar bearing" flagellates was by Henry James-Clark (see plate ~~above~~) who also pointed out the striking similarity of these flagellates to choanocytes of sponges. His observations began a debate, nicely reviewed, concerning the origin of sponges and metazoa~~n~~ carried on for decades involving heavyweights of biology such as William Saville-Kent and Ernst Haeckel. It is now known that choanoflagellates are poor candidates for a direct ancestor to multicellular animals. Leadbeater aptly comments "Reconstruction of hypothetical 'missing links' on the basis of extant morphological and molecular data is a perfectly respectable profession. However, in the absence of a fossil record, the origin of multicellular animal life from single-celled ancestors remains one of the most enigmatic of all unresolved phylogenetic problems".

The second chapter focuses on functional morphology, the structures and physics of feeding and locomotion as well as ultrastructure. Contrary to one might expect,





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flagellar motion creates a feeding current around the collar rather than drawing water into the collar. Prey, generally bacterioplankton, are captured on the outside of the collar and transported to a zone of phagocytosis at the base of the collar. Subsequent chapters are devoted to the two clades of choanoflagellates, the Craspedida with exclusively organic coverings (chapter 3) and the "loricate" Acanthoecida with their collars formed of intricate silicate strips (chapter 4). Silicate metabolism is covered in chapter 5. The next suite of chapters can be described as describing the important variations around a common theme or manner of forming loricas in distinct groups: nudiform in which a daughter cell forms a new lorica de nova (chapter 6) and tectiform in which the daughter cell assembles a new lorica from components formed before cell division (chapter 7). Remarkably some species can switch between the two modes. The evolutionary relationship between these distinct ontogenies is the subject of chapter 8.

The ecology of choanoflagellates and heterotrophic nanoflagellates in general is reviewed in chapter 9. Perhaps not surprisingly given their intricate morphologies, choanoflagellates appear to be overall "K" rather than "r" strategists as heterotrophic nanoflagellates. Leadbeater points out that field studies are biased toward marine waters. While many species could reasonably be described as cosmopolitan, there are species largely restricted to either inshore coastal areas and others found in open ocean waters. Interestingly, the best-studied systems in terms of choanoflagellates appear to be the polar seas. The last chapter addresses the topic of choanoflagellate phylogeny and returns to the theme, which first drew attention to these protists—the evolution of metazoan multicellularity. The chapter introduced a field unknown to this reviewer including considerations of "Ancient origins of Hedge and Hog domains" and "Hippo signaling pathway". The concluding paragraph of the book states that after almost 150 yr after Henry James-Clarke's assertions, it is clear that choanoflagellates are closely related to animals what is unclear is exactly how- a past subject still for the future. 2

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